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Volume 2. Permutated Index of Chemicals, Microbial Populations, and Wastewater Treatment Systems with Bibliography

by

Franklin Research Center
Philadelphia, Pennsylvania 19103

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Project Officer

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16. ABSTRACT

Post-1974 literature on wastewater treatment was retrieved by on-line searching of eight databases. From 1,000 articles critically examined, 600 were used to generate a three-tiered permutated index keyed to, and presented with the 600 article bibliography in Volume 2; the three levels of the index are name of chemical, name of microbe affecting or affected by said chemical, and treatment process involved. These same 600 articles were used to generate separate biodegradable and nonbiodegradable lists of chemicals, on which a successful feasibility study was carried out to create an algorithm to predict biodegradability using only substructural fragments and molecular weight. The results of this study, in Volume 1, indicated 93% accuracy for biodegradables, but only 70% for nonbiodegradables due to the inadequate selection available. Also in Volume 1 is a report on technological advances in wastewater treatment gleaned from the 1,000 documents. In the same section, in tabular format, are references to commercial literature and some journal articles, supplied with this report to EPA, obtained by canvassing Japanese and West German manufacturers in this field. Rounding out Volume 1 is a condensation of abstracts from the 1913-1974 literature dealing only with adverse effects of chemicals on wastewater treatment, also in tabular format; it is intended to complement references to this topic in the permutated index.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Biodeterioration Chemical removal Indexes (documentation) Mathematical prediction Sewage treatment Waste treatment	Permutated index	Field - Group 12 A 13 B 68 D

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FOREWORD

The U. S. Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimonies to the deterioration of our natural environment. The complexity of that environment and the interplay of its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution; it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems to prevent, treat, and manage wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, to preserve and treat public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research and provides a most vital communications link between the researcher and the user community.

Franklin Research Center has created a permutated index of the world's literature on wastewater treatment over the period 1974-1979. The three items of information which were extracted from nearly all of 600 articles, and used as the main levels of the index, are name of chemical, name of degrading or affected microorganism, and wastewater treatment process. Each entry is keyed to the bibliographic entry from which it derived.

Francis T. Mayo, Director
Municipal Environmental Research
Laboratory

ABSTRACT

This report presents an in-depth hierarchical index and bibliography of 600 post-1974 literature references on aqueous biodegradability of chemicals. The companion report, in Volume 1, presents 1) the results of a successful feasibility study for prediction of biodegradability solely from positive or negative values assigned to standard molecular substructural units - also based on these same 600 articles, 2) brief abstracts of post-1974 advances in wastewater treatment technology plus a guide to current Japanese and West German commercial literature in this field, and 3) a listing from the 1913-1974 literature of chemicals with adverse effects on wastewater treatment processes; the effects and original reference are given.

The index is searchable at three levels, 1) chemical name or chemical class, 2) name of microorganism, or type of microbial population, affecting or being affected by the chemical, 3) wastewater treatment process. The process level is very broad in scope, including such concepts as structure-activity studies, operational parameters, inhibition/toxicity studies, review articles, etc., but many true treatment concepts are exploded to allow easier access to specialized technology via the terminology used in the literature. Certain almost omnipresent concepts are retained as third levels of a particular main entry but are suppressed in the permutating process, even if they are the only entry at the third level, and are not directly searchable.

This report was submitted in fulfillment of Contract No. R806699-01 by Franklin Research Center under the sponsorship of the U. S. Environmental Protection Agency. This report covers the period July 15, 1979 to April 30, 1981, and work was completed as of May 15, 1981.

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ACKNOWLEDGMENT

Preparation of the index and bibliographic citations was under the direction of the Toxicology Information Department of the Science Information Services Organization of the Franklin Research Center, Philadelphia, Pennsylvania.

SECTION 1

INTRODUCTION

This report is made up of an in-depth hierarchical index and compilation of bibliographic citations to the biodegradability of chemical substances in water; full-text copies of papers accompany the index and bibliographic citations.

PURPOSE

The in-depth hierarchical index and accompanying compilation of bibliographic citations were created with the intent of providing the sanitary engineer, the environmental chemist, and the microbiologist with a concise and readily accessible source of information on the biodegradation of chemicals associated with wastewater treatment plants.

The online retrieval of pertinent world literature covers the period from 1974-79 as well as articles published during 1970-73 that did not appear in a previously published EPA study in 1974 (NTIS PB-243-825). Foreign language articles are included to emphasize the worldwide interest of this increasing environmental problem.

THE PERMUTATED INDEX

The creation of a three-tiered, hierarchical permutated index affords the separation of critically analyzed information and the reassembly of this information into concise but convenient and practical units. The various hierarchical levels are described below.

NOMENCLATURE

Chemical Nomenclature (First Tier)

The final choice of chemical names appearing in the index represents a third-generation compromise involving utility to professionals of widely diversified chemical background, industrial importance, an awareness of the relative insensitivity of the biodegradability of closely related homologues to the presence of nontoxic substituents, and, finally, the traditional mechanics of permutated index creation.

To facilitate locating a specific chemical of interest, the following explanatory guidelines are offered:

a. Many of the simpler aliphatic compounds were concentrated under generic names; the exceptions were properly cross-referenced. For example, oxalic acid is listed under Alkanoic acids and derivatives, polybasic; whereas adipic acid, found as a separate entry, is additionally listed as a "See Also" under Alkanoic acids and derivatives.

b. Significant subclasses within traditional major organic headings were accorded major-heading status as exemplified by:

Alcohols, tertiary aliphatic
Amines, poly-, aliphatic
Benzenesulfonic acid, non-linear alkyl, long chain

c. The major benzene derivatives appear as a condensed separate entry under the common or familiar name, such as Aniline and derivatives, Phenol and derivatives, Xylenes and derivatives, and Benzoic acid and derivatives.

d. Aromatic compounds having more than one common functional group and not sharing a common name are indexed under more than one appropriate entry to facilitate locating them. Where feasible, polyfunctional benzenes have been indexed under the common name indicating the greatest number of substituents.

e. Specific pesticides are listed as cross-references under the general major heading of Pesticides; herbicides are subclassified by tradename type under the heading of Herbicides.

f. Surfactants are subclassified and listed as to respective appropriate ionic type and are additionally referred to the specific main chemical class heading.

g. Acronyms, such as PCB and PVA, are referenced to their respective complete generic name.

h. Extensive cross-indexing is included to assist the investigator to locate readily the probable source(s) of desired information.

Microbial Population (Second Tier)

The microbial populations responsible for the biodegradation of the chemical substances make up the second level of the permutated index. Major classes of these microbial populations, created to facilitate designation of the system with the major role in the biodegradation process, are as follows:

a. Activated sludge, either without qualification (where none was indicated in the original text) or with terms to provide an added dimension to describe the specific source and/or some process as it appeared in the original study.

b. Microbial population, mixed, again either without qualifications or with descriptive terms designating the natural residence of these populations.

c. Microbial populations as pure cultures, which for purposes of convenience and brevity are identified solely by their respective genera. No further identification by species or strain is indicated in the index, although this information in many instances does appear in the full-text copy of the original paper.

d. Microbial populations that are significant but used less, such as sewage (either natural or synthetic) and lagoons.

Wastewater Treatment Processes (Third Tier)

The third tier of the permutated index is concerned with the major significant biological wastewater treatment processes. Included are physical and biochemical processes encompassing aerobic and anaerobic biodegradation, metabolic pathways (without identification of the respective metabolites), operational parameters of the processes, as well as kinetics of the biodegradation process. In addition, information pertinent and salient to each respective study may be included to provide accessibility of this specific information to an interdisciplinary group to whom this index is of use and interest. Since this information is specific and self-limiting in its scope to each respective study, it is not permutated against the first and second tiers.

In contrast, headings of major interest and importance to overall interdisciplinary groups (such as structure-activity relationships, review articles, sludge acclimatization processes, inhibitory/toxic effects with or without appropriate parameters as preservatives, pH effect, nutritional effects, etc.) are permutated against both the chemicals (first tier) and microbial populations (second tier).

In conclusion, it is hoped that the permutated index will, indeed, provide a useful source of information presented in a logical, readily accessible form.

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